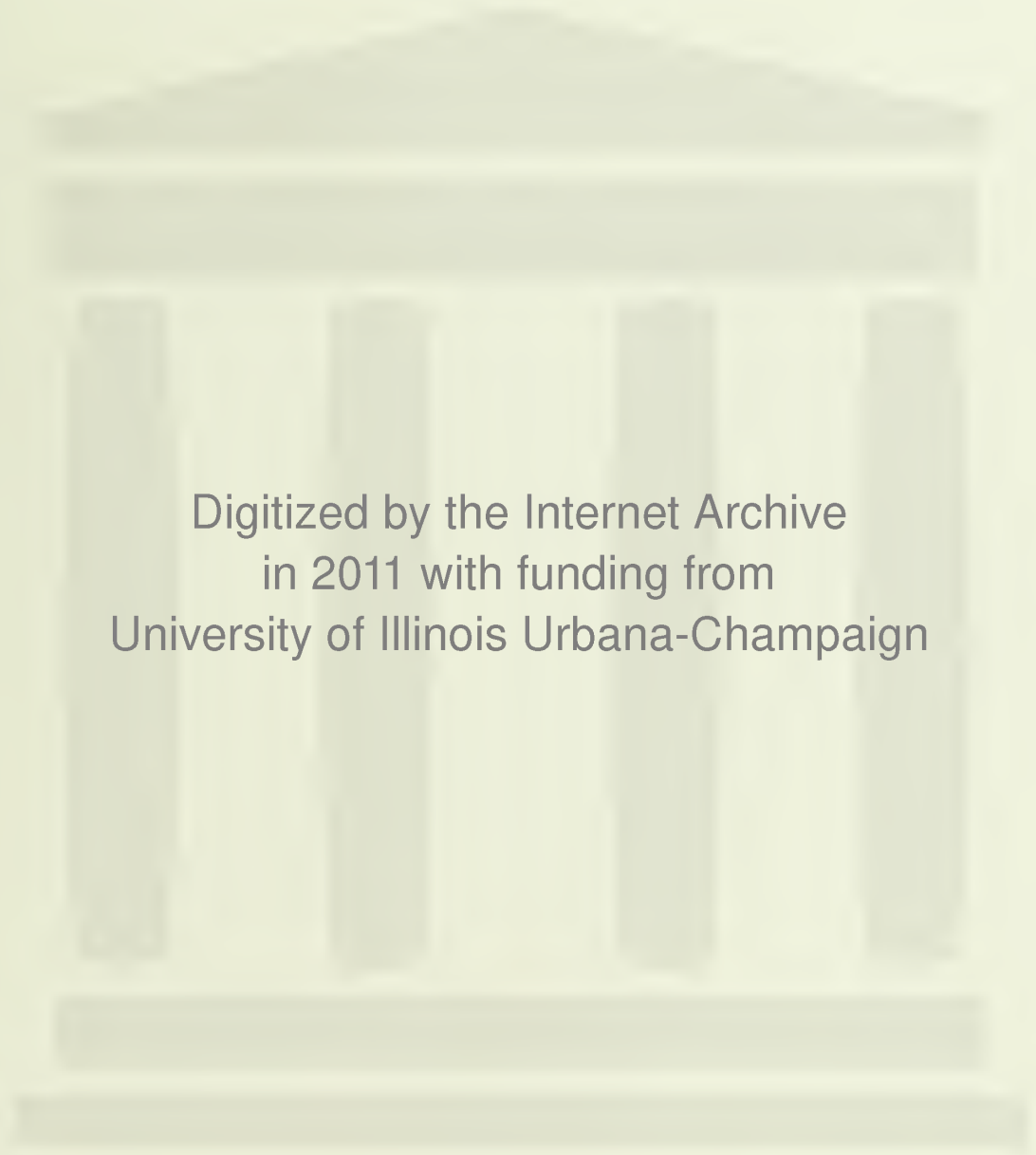

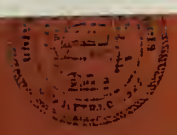

BEBR

FACULTY WORKING
PAPER NO. 1032

Horizontal Equity and Taxpayer Characteristics of Those Unfairly Treated by the Tax System

Jane H. Leuthold
Ralph D. Husby

College of Commerce and Business Administration
Bureau of Economic and Business Research
University of Illinois, Urbana-Champaign

FACULTY WORKING PAPER NO. 1032

College of Commerce and Business Administration

University of Illinois at Urbana-Champaign

April, 1984

Horizontal Equity and Taxpayer Characteristics of Those Unfairly Treated by the Tax System

Jane H. Leuthold, Professor
Department of Economics

Ralph D. Husby, Associate Professor
Department of Economics

ABSTRACT

Previous studies have suggested that the tax system does not seriously alter the ranking of utilities of taxpaying families. In this paper, that question is investigated further. We arrange a sample of families into four groups: a low tax, low utility group; a low tax, high utility group; a high tax, low utility group; and a high tax, high utility group. We define the middle two groups as unfairly treated (positively or negatively) by the tax system. The results of this study indicate that 25 percent of our sample is unfairly treated. The characteristics of those families suggest aspects of the tax system that are poorly conceived.

Musgrave (1959, p. 160) states that "Perhaps the most widely accepted principle of equity in taxation is that people in equal positions should be treated equally." This principle is known as the principle of horizontal tax equity. Musgrave (1976), Feldstein (1976), and others point out that horizontal equity has suffered from neglect in recent studies emphasizing tax efficiency. Part of the reason for this neglect is that efficiency is much easier to define and measure than is equity.

As Feldstein notes, if all individuals have the same utility function, horizontal equity requires simply that taxpayers with the same consumption bundles (goods and leisure) be taxed equally. The possibility of diversity of tastes led Feldstein to suggest the following principle of horizontal equity:

> If two individuals would be equally well off (have the same utility level) in the absence of taxation, they should also be equally well off if there is a tax.[1]

When preferences differ, a ranking by consumption bundles is no longer adequate and a utility ordering of households becomes necessary.

Rosen (1978) applied Feldstein's utility definition of horizontal equity to evaluate the equity of the present tax structure. Assuming family utility functions of the constant elasticity of substitution (CES) form, and using 1967 National Longitudinal Sample data for mature women ages 30-44 years, Rosen estimated family utility function parameters for the sample of families. Preferences were allowed to differ by race and by the presence of preschool children. He then

computed the Spearman rank correlation between utilities before and after tax and found that the ranking of utilities is not appreciably altered by the tax system.

This study is also an attempt to explore the horizontal equity of the tax system but differs from Rosen's in several ways. First, our concern is not with the effect of the tax system on the utility rankings of households but with the characteristics of those households which are treated unfairly by the tax system. Like Rosen, we estimate the parameters of family utility functions using a cross-section sample of data, but have a more representative and current sample. We find that those unfairly advantaged by the tax system tend to have lower family incomes, to be mostly nonblack, to have more children, and to be better educated than those families unfairly disadvantaged by the tax system. Those unfairly disadvantaged by the tax system are more likely to be two-earner families, rent their homes, and be non-professionals.

In section I of this paper, we develop our definition of horizontal equity for this project. Section II is a discussion of the estimation of the utility levels of our sample of families. In section III, we identify those households unfairly treated by the tax system and examine their characteristics. Section IV summarizes the results and their implications for future research.

I. Horizontal Equity Defined

Our definition of horizontal tax equity holds that if $U_i \gtrless U_j$ for households i and j, then it should be the case that $T_i \gtrless T_j$ where U is

the utility level and T the tax liability of the household. Summing across households, this implies that if

$$\sum_{i=1}^{n} U_i \gtrless nU_j, \qquad \text{then} \quad \sum_{i=1}^{n} T_i \gtrless nT_j$$

or, alternatively, if

$$\frac{U_j}{\overline{U}} \lessgtr 1, \qquad \text{then} \quad \frac{T_j}{\overline{T}} \lessgtr 1$$

where $\overline{U}$ and $\overline{T}$ are the mean utility and tax levels for all households. Accordingly, we define a household as unfairly advantaged by the tax system if $U_j/\overline{U} > 1$ and $T_j/\overline{T} < 1$ and a household as being unfairly disadvantaged by the tax system if $U_j/\overline{U} < 1$ and $T_j/\overline{T} > 1$.

By our definition, families fall into four categories: lower than average utility and lower than average taxes, higher than average utility and lower than average taxes, lower than average utility and higher than average taxes, and higher than average utility and higher than average taxes. These possibilities are summarized in Table 1. Groups I and IV are fairly treated by the tax system (according to our definition), group II is unfairly advantaged by the tax system, and group III is unfairly disadvantaged by the tax system.

II. Estimating Utility Levels

In this study, we assume that family utility depends on family disposable (after-tax) income and the leisure time of the two spouses; specifically, family preferences are defined by the Cobb-Douglas utility function:

Table 1: Household Groups

	$U_j/\overline{U} < 1$	$U_j/\overline{U} \geq 1$
$T_j/\overline{T} < 1$	I	II
$T_j/\overline{T} \geq 1$	III	IV

$$(1) \qquad U = a_1 \ell n Y_d + a_2 \ell n L_1 + a_3 \ell n L_2$$

where Y_d is family disposable income, L_1 and L_2 are the leisure hours of the husband and wife, and the a's are positive constants that sum to one.[2] We further assume that the family faces two constraints: (1) family disposable income must be equal to the sum of the husband's earnings, the wife's earnings, and the nonwork income of the family minus the family tax liability, and (2) hours worked plus hours of leisure cannot exceed the number of hours available. In particular, we assume:

$$(2) \qquad Y_d = Y - T(Y-e) = w_1 N_1 + w_2 N_2 + I - T(Y-e)$$

and

$$(2b) \qquad K = N_j + L_j \qquad j = 1,2$$

where Y is family money income before tax, T(Y-e) is the family income tax liability, e is total exemptions and deductions, w is the hourly wage, N is hours of market work, I is nonwork income (income from investments, for example), K is the fixed amount of time available, and the subscripts denote the husband and wife, respectively.

The income tax is a bracket tax on family taxable income, Y - e. The tax function is given by

$$(3) \qquad T(Y-e) = t(Y-e-Y_{min}) + T(Y_{min})$$

where t is the bracket tax rate for the bracket in which Y-e is observed, Y_{min} is the minimum income in that tax bracket, and $T(Y_{min})$ is the tax payable on that minimum income.

Maximization of (1) subject to (2a), (2b), and (3) yields the following work offer curves for the husband and wife:

$$(4a) \qquad N_1 = (1-a_2)K - a_2\left[\frac{I(1-t)+te+tY_{min}-T(Y_{min})}{w_1(1-t)}\right] - a_2K\frac{w_2}{w_1}$$

$$(4b) \qquad N_2 = (1-a_3)K - a_3\left[\frac{I(1-t)+te+tY_{min}-T(Y_{min})}{w_2(1-t)}\right] - a_3K\frac{w_1}{w_2}$$

which relate hours of work to their wage, their spouse's wage, nonwork income, and the parameters of the tax system. The importance of the work offer curves is that they allow us to estimate the parameters of the utility function, a_1, a_2, and a_3.

Substituting (4a) and (4b) back into the utility function (1) gives the indirect utility function:

$$(5) \qquad V = \ell n[w_1(1-t)K + w_2(1-t)K + I(1-t) + te + tY_{min} - T(Y_{min})]$$
$$- a_2\ell nw_1(1-t) - a_3\ell nw_2(1-t) + a_1\ell na_1$$
$$+ a_2\ell na_2 + a_3\ell na_3$$

which depends on the family's full income (its total income if both the husband and wife worked the total time available), the hourly wages of the husband and wife, the tax parameters, and the parameters of the utility function.[3] The only unknowns in this function are the parameters of the utility function which we estimate indirectly by estimating the work offer curves, (4a) and (4b), for a sample of husband-wife families. Given the estimates of the utility function parameters, we then compute utility levels for all households.

The sample of husband-wife families used in this study was drawn from the 1980 Michigan Survey of Income Dynamics. The data set contains information on income, wage, hours of work, and family demographic characteristics as well as tax information on total tax liability and marginal tax rate. A subset of 1,972 husband-wife families formed the basis for our study. Families on welfare, families in which the husband was less than 18 or more than 65 years of age, and families with negative nonwork income were excluded from the sample because we felt that behavior of these families would not be well described by the work-leisure choice model of our study.

To estimate the work-offer curves of husbands and wives we used restricted least squares. Our estimation model was of the form:

$$(6a) \qquad N_1 = \beta_0 + \beta_1 \left[\frac{w_2(1-t)K + I(1-t) + te + tY_{min} - T(Y_{min})}{w_1(1-t)} \right] + \varepsilon_1$$

$$(6b) \qquad N_2 = \gamma_0 + \gamma_1 \left[\frac{w_1(1-t)K + I(1-t) + te + tY_{min} - T(Y_{min})}{w_2(1-t)} \right] + \varepsilon_2$$

where $\beta_0 = (1-a_2)K$, $\beta_1 = -a_2$, $\gamma_0 = (1-a_3)K$, and $\gamma_1 = -a_3$, and the ε's are disturbance factors. Adding the restrictions that $(1+\beta_1)K = \beta_0$ and $(1+\gamma_1)K = \gamma_0$, where K is taken as 8,760 hours per year, allowed us to identify the parameters of the utility function.[4] To permit preferences to vary over the population, the work offer curves were estimated over four subgroups of the sample based on race (black and nonblack) and education (12 years or less of school and more than 12 years of school).

Since, in the case of some families the wife was not employed and therefore had no observed wage, and since the wage is measured with error for wives who were employed, we used the Heckman (1980) method to obtain a consistent estimate of the potential wages of wives in our sample. Using the Heckman method, we first estimated (using probit analysis) the probability that a wife worked outside the home. Second, we estimated a wage equation through regression analysis, using the parameters of the probit estimation to adjust for bias in the estimation of the wage. The wage equation was then used to impute a wage to all wives in the sample.

The data contained information on the family's marginal tax rate, t, and total income tax liability, T(Y-e). This information was used to infer the other tax parameters by solving for the unknown tax parameters in equation (3). This gave us:

$$(7) \qquad te + tY_{min} - T(Y_{min}) = tY - T(Y-e)$$

which we calculated for each household in the sample. In estimating our model it was assumed that the tax brackets are sufficiently wide that small changes in income do not cause changes in tax brackets. This allowed us to disregard nonlinearities in the tax function and use ordinary least squares to estimate our model.[5] Hausman and others have developed complicated estimation techniques for dealing with tax nonlinearities, but for simplicity, we chose to disregard this problem.[6]

Measurement of the other variables in the study was straightforward. Hours of work were measured annually, the husband's wage

was computed by dividing earnings by hours worked, and nonwork income was computed as the residual of total family income and the earned income of the husband and wife. Estimates of the wage equations for black and nonblack wives appear in Table 2. The columns headed LFP give the results of the probit estimation of the probability that the wife participates in the labor force. The wage equation shows that city size has a positive influence on the wife's wage while the wage increases with years worked but at a decreasing rate. The education level of the wife was entered as a series of dummy variables with 17 or more years the omitted category. The negative coefficients indicate that those with less than 17 years of education earn a lower wage and that generally, the lower the education level, the lower the wage. The insignificant coefficient on the probit lambda variables indicates that censorship was probably not an important problem in the estimation.

The wage function was used to impute a wage to each woman in the sample and the work offer curves were estimated using restricted least squares. The results of the estimation are in Table 3. The slopes, estimates of the utility function parameters, are all between zero and one as required by theory.

Table 4 shows the utility parameters implied by the regression slopes for the four population subgroups. The parameter a_1 reflects the family's utility weight on income and was estimated to be higher for those with more than 12 years of school. This is an expected result if families view education as an investment in higher future income. The parameters a_2 and a_3 are the family utility weights on the husband's and the wife's leisure, respectively. For nonblacks,

Table 2
ESTIMATES OF THE WAGE EQUATIONS FOR BLACK AND NONBLACK WIVES
(t ratios in parentheses)

Explanatory Variables	Nonblack		Black	
	LFP	Wage	LFP	Wage
Constant	2.821	8.585	3.684	7.159
	(10.221)	(13.540)	(5.218)	(6.465)
Nonwage income	-.484E-5	--	-.978E-5	--
	(-1.254)		(-.674)	
City size	-.0416	1.049	-.121	1.150
	(-.559)	(5.085)	(-.761)	(3.934)
Education				
0-5 years	-.747	-8.049	.718	-5.884
6-9 years	-.748	-6.156	-.509	-5.360
10 years	-.703	-5.186	-.625	-4.932
11 years	-.276	-4.843	-.727	-6.521
12-13 years	-.474	-4.935	-.542	-4.321
14 years	-.165	-3.887	-.356	-3.627
15 years	-.284	-3.285	-1.914	-5.551
16 years	-.118	-2.762	.492	-2.573
Years worked	.896	.133	.124	.065
	(5.149)	(3.043)	(3.875)	(1.061)
Years worked squared	-.000983	-.00215	-.00198	-.00173
	(-1.649)	(-1.448)	(-1.983)	(-0.852)
Husband's wage	-.0182	--	-.00582	--
	(-3.520)		(-.589)	
Children				
1-2 years	-.705	--	-.482	--
3-5 years	-.499	--	-.203	--
6-13 years	-.140	--	-.109	--
Age	-.0577	--	-.0858	--
	(11.448)		(-6.550)	
Home ownership	.178		.259	
	(1.785)		(1.608)	
Probit Lambda	--	-.191	--	.459
		(-.730)		(1.198)
R^2	--	.205	--	.208
-2 times log likelihood ratio	295.89	--	96.62	--
Sample size	1507	1014	465	353

Table 3

Estimates of the Work Offer Curves

	Nonblack		Black	
	Slope	$\bar{R}^2$	Slope	$\bar{R}^2$
Education ≤ 12				
Husbands	-.249 (-40.71)	.669	-.387 (-64.04)	.918
Wives	-.241 (-58.48)	.806	-.184 (-25.64)	.644
Education > 12				
Husbands	-.224 (-31.27)	.588	-.384 (-34.55)	.923
Wives	-.224 (-51.26)	.793	-.141 (-10.71)	.537
All				
Husbands	-.237 (-50.68)	.630	-.387 (-72.80)	.919
Wives	-.233 (-77.49)	.799	-.172 (-27.16)	.614

Notes: $\bar{R}^2$ is adjusted R^2. Numbers in parentheses are t-ratios.

Table 4

Utility Parameters by Type of Family

Group	a_1	a_2	a_3	Utility level	Sample size
Nonblack, Education ≤ 12	.510	.249	.241	.971	822
Nonblack, Education > 12	.522	.224	.224	1.199	685
Black, Education ≤ 12	.429	.387	.184	.727	365
Black, Education > 12	.474	.385	.141	.866	100
All	.525	.260	.215	1.000	1972

our estimates showed little difference in these weights between husbands and wives although black families place a higher weight on the husband's than on the wife's leisure according to our estimates. The utility level was calculated on the basis of the estimated weights for each of the four subgroups and is shown in the table. Since the utility level has only a relative significance, it is shown as a ratio to the population mean utility level. The group with the highest utility level is nonblacks with more than 12 years of education while the group with the lowest utility level is blacks with less than 12 years of education.

In the next section, we discuss the tax implications of these results.

V. Tax Treatment of Households

Recall from our earlier definition that groups I and IV are fairly treated by the tax system in that they either have lower utility than average and pay lower taxes (group I) or have higher utility than average and pay higher taxes (group IV). As seen in Table 5, 50% of our sample falls into group I and 25% into group IV. The remaining 25% falls into groups II and III, those unfairly treated by the tax system.

Those in group II, 17%, have higher utilities than average and pay lower taxes. They are unfairly <u>advantaged</u> by the tax system, while those in group III (8% of the sample) have lower utilities than average and pay higher taxes. They are the unfairly <u>disadvantaged</u>.

Table 5

Characteristics of Taxpayer Groups

	Group			
	I	II	III	IV
% of households	50%	17%	8%	25%
Family income	$18,618	$26,547	$34,204	$46,474
% Nonblack	62%	99%	54%	99%
No. of kids	1.30	1.21	.95	.70
% Homeowners	65%	89%	73%	92%
% with eduction > 12	19%	64%	25%	70%
% Professional	17%	49%	24%	61%
% Mortgage holders	52%	75%	59%	76%
No. earners	1.7	1.5	1.9	1.7

Unexpectedly, those unfairly advantaged by the tax system (group II) have a lower average income than those unfairly disadvantaged (group III). This suggests that lower income families pay lower taxes, but do not necessarily have lower utilities. What are the characteristics of the unfairly advantaged group? Besides having slightly lower incomes than the unfairly disadvantaged, the favored group II households are almost all nonblack (99%) and tend to have more children than do the unfairly disadvantaged. They are also more likely to be homeowners (89% vs. 73% of the unfairly disadvantaged own houses) and more likely to be mortgage holders (75% as opposed to 59%).

The unfairly disadvantaged, on the other hand, have lower education levels, fewer professionals, and more two earner families. As shown in Table 5, only 25% have more than 12 years of school while 64% have more than 12 years school in group II. It is also seen that families in the unfairly disadvantaged group have on average 1.9 workers, the highest of any group.

What explains these differences in characteristics? Part of the difference may be the higher education and professional occupations that are characteristic of the favored group. However, this group also appears to have characteristics that enable them to reduce their tax liabilities, such as more dependents, home ownership, and mortgages. Those in the unfairly disadvantaged group lack these same opportunities for reducing tax liability. Accepting our utility measure, this suggests that perhaps the dependents and homeowner allowances in the income tax are overly generous.

IV. Conclusions

We found in our study that a sizeable portion of our sample, 25%, were unfairly treated by the income tax. This result is contrary to Rosen's (1978) that there do not seem to be major departures from horizontal equity in the income tax. The difference in results may be due to the use of different measures of horizontal inequity. It may also be due to the use of different utility functions or data sets.

Our measure of horizontal inequity was simply to identify which households have higher (lower) utility than average and pay lower (higher) taxes than average. These households were judged to be unfairly advantaged (disadvantaged) by the income tax. Our methodology did not allow us to identify the extent of the inequity, but did allow us to specify the characteristics of the unfairly treated groups. Rosen's measure, on the other hand, allowed him to say something about the strength of the horizontal inequity (for a particular, small subsample of the population), but did not allow him to identify the characteristics of the unfairly treated group.

No conclusions regarding the overall equity of the income tax can be drawn from either Rosen's or our study. Both studies focussed on one aspect of equity, horizontal equity, and neglected the much more difficult area, vertical equity. Likewise, both studies take the household as the unit of analysis, even though utility is an individual concept. Hence, the Cobb-Douglas utility function used in this study can be thought of as an approximation to the social welfare function of the family. The question of how individual utilities in the social welfare function should be weighted is ignored. This, and

other issues raised earlier provide interesting areas for future research.

FOOTNOTES

[1]Feldstein (1976, p. 79).

[2]The Cobb-Douglas utility function was selected for its convenient properties (linear work offer curves and a tractable indirect utility function) but has the undesirable feature of constraining the elasticity of substitution between arguments in the utility function to be one.

[3]See Varian (1978, p. 94) for the derivation of the indirect utility function in the one person Cobb-Douglas case.

[4]The restrictions were derived by eliminating a_2 from the β-coefficients and a_3 from the γ-coefficients. Total time available was computed by multiplying 24 by 365.

[5]This approach was followed successfully by Wales and Woodland (1977).

[6]See Hausman (1981).

REFERENCES

Feldstein, M., "On the Theory of Tax Reform," Journal of Public Economics, VI, Nos. 1,2 (July/August 1976): 77-104.

Hausman, J. A., "Labor Supply," in Aaron, H. J. and Pechman, J. A., eds., How Taxes Affect Economic Behavior (Washington, D.C.: The Brookings Institution, 1981): 27-83.

Heckman, J. J., "Sample Selection Bias as a Specification Error with an Application to the Estimation of Labor Supply Functions," in Smith, J. P., ed., Female Labor Supply: Theory and Estimation (Princeton: Princeton University Press): 206-248.

Musgrave, R. A., The Theory of Public Finance (New York: McGraw-Hill, 1959).

_____, "Optimal Taxation, Equitable Taxation and Second-Best Taxation," Journal of Public Economics, VI, Nos. 1,2 (July-August 1976): 3-16.

Rosen, H. S., "An Approach to the Study of Income, Utility, and Horizontal Equity," Quarterly Journal of Economics, XCII, No. 2 (May 1978): 307-322.

Varian, H. R., Microeconomic Analysis (New York: W. W. Norton, 1978).

Wales, T. J. and Woodland, A. D., "Estimation of the Allocation of Time for Work, Leisure, and Housework," Econometrica, XLV, No. 1 (January, 1977): 115-132.